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three great men of the classical period of the Gotha institution. For the needs of modern geography require more and more a continuous co-operation of geographer and cartographer in the production of maps. The time is gone when scientific geographers were strangers to the cartographical arts and accepted their products with gratitude and without criticism. Geographers of the present want to advise and co-operate in the making of maps, and they attribute to the scientific foundations of the map the same value as to its cartographical perfection. In this respect the Gotha of to-day is holding its own among its contemporaries in no less a degree than did the Gotha of old at the time of Petermann, Vogel, and Berghaus.

HARSHBERGER'S "PHYTOGEOGRAPHIC SURVEY OF NORTH AMERICA"*

A REVIEW

By ROLAND M. HARPER

In 1896 Prof. Adolf Engler of Berlin, who is perhaps the greatest all-round botanist in Europe to-day, and Prof. Oscar Drude of Dresden, a phytogeographer of world-wide reputation, with the intelligent co-operation of a publishing house which has had long experience with scientific books, and with characteristic German thoroughness, began the publication of a series of large octavo monographs under the general title of "Die Vegetation der Erde," apparently designed ultimately to describe the vegetation of the whole world. These monographs have been appearing ever since at the rate of nearly one a year, averaging about 500 pages. It was the original intention to print them all in German, but an exception has been made in the case of the present one, and wisely so, for its English-speaking readers must form a large majority. Most of the monographs hitherto published in this series deal with small parts of Europe, but there is already one on Western Australia, one on Chile, and one on the Peruvian Andes. No. IX is devoted to Africa, but that is being published in parts, of which three, aggregating nearly 1500 pages, have been issued, and more are promised; while the whole of our most diversified continent, from the Arctic Circle to Panama, is treated in No. XIII, a volume of less than 900 pages.

The preparation of the monograph on North America was entrusted soon after the inception of the work to Dr. J. W. Harshberger of the University of Pennsylvania. After five years of work on the manuscript and nearly as much time spent in seeing it through the press, the book was issued early in the summer of 1911. It is the largest volume in the series, if the parts of Prof. Engler's own monograph on Africa are counted as separate volumes. Although at least six botanical reviews of it have already been published in this country,* it deserves to be discussed also from a geographical point of view, as there is much in it to interest geographers. Two of the reviews here cited are hostile criticisms, while the others are commendatory or nearly impartial; and it is interesting and somewhat significant from a geographical standpoint that the two reviewers who have found the most fault with the work have traveled much less than have those who have praised it.

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* Phytogeographic Survey of North America. A consideration of the phytogeography of the North American continent, including Mexico, Central America and the West Indies, together with the evolution of North American plant distribution. (*Die Vegetation der Erde*, *XIII.*) By John W. Harshberger, A.B.,B.S.,Ph.D. Pp. lxiii+790. 18 plates and map. Leipzig, Wilhelm Engelmann (also New York, G. E. Stechert & Co.), 1911. Price 52 marks, unbound (53.50 marks bound).

For the stupendous task of sketching the vegetation of North America probably no better equipped person could have been selected than Dr. Harshberger. While other American phytogeographers have been studying herbarium specimens, gathering climatic data, or delving deeply into various special problems, he has spent many of his vacations in the last two decades in traveling over the country and taking notes, which he has shared generously with the readers of botanical periodicals. Before completing the manuscript of this book the author had visited nearly every state in the Union outside of the southeastern pine-barren region and the southwestern desert region, as well as Quebec, Ontario, Mexico, Jamaica, Haiti and Bermuda. Probably none of his reviewers has seen quite as much of North America as he has.

The contents of the volume may now be summarized. After the preface, table of contents, and a 51-page German synopsis by Prof. Drude, the work is divided into four parts, namely: (1) history of exploration, with bibliography (92 pp.); (2) geology, topography, climate, and a few floristic statistics (77 pp.); (3) geological history of the flora, geographical affinities, and summary of a few previous systems of regional classification for this continent (176 pp.); (4) vegetation regions of North America and their subdivisions, with descriptions of vegetation (359 pp.).

The bibliography in Part 1 covers 47 pages, with about 1,500 titles, covering a wide range of subjects, from bare lists of plants with no information about habitats, to papers that are primarily geological. It is divided into one general and eight special parts, the latter corresponding to rather arbitrary geographical divisions, following political boundaries for the most part, as so many of the individual papers do. Although the author disclaims any pretension of completeness for this bibliography, and one could easily point out errors, it is undoubtedly the most complete of its kind yet published, and it ought to fill a long-felt want. Owing to the length of time required for such a large book to go through the press, and the fact that the bibliography comes near the beginning, it is brought down only to 1908; but many papers published in 1909 are mentioned in footnotes farther on. One cannot help admiring the patience and impartiality with which the author sifted such a vast mass of literature, to extract from each paper the kind of information that was needed for his book.

The nature of Part 2 can be easily imagined from its title. Part 3 deals mainly with paleobotany and botanical history, a subject in which Prof. Engler is greatly interested (which accounts for its inclusion in nearly all the volumes of the series), and which was not entirely new to Dr. Harshberger. Nearly four pages are devoted to this part in Prof. Campbell's review, to which the reader is referred for further particulars. Chapters 3 and 4 of Part 3, which deal with the postglacial history and geographical affinities of the flora, contain many plant lists and other matter almost duplicated in Part 4. Part 3 closes with a 4-page review of the geographical classifications of Meyen (1836), Grisebach (1872), Engler (1879-1882), Drude (1890), Merriam (1894, 1898), Clements (1902), Engler (1902), and the author. One might suppose from reading his explanation here of how his map was constructed that it was based primarily upon Merriam's,* but an examination of the map itself gives a different impression, as will be pointed out farther on.

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* Taylor, *Torreya*, Vol. 11, pp. 190–199, Sept. 1911 (replied to by Harshberger in the next number); Fernald, *Rhodora*, Vol. 13, pp. 213–224, Oct. 1911; Bessey, *Science* II, Vol. 34, pp. 810–812, Dec. 8, 1911; Shreve, *Plant World*, Vol. 14, pp. 277–280, Nov. 1911; Cowles, *Botanical Gazette*, Vol. 53, pp. 181-182, Feb. 1912; Campbell, *American Naturalist*, Vol. 46, pp. 166–184, March 1912.

Part 4, constituting nearly half the book, is of course the most important, and the one which called out the author's best talents. In this the continent and outlying islands are divided into seven main divisions, as follows: (1) Arctic and subarctic; (2-4) temperate zone (Atlantic, interior and Pacific sections); (5) subtropical Mexico; (6) tropical Mexico and Central America; (7) West Indian region, including South Florida, the Bahamas and Bermuda at its northern limits, but apparently not the Lesser Antilles (which were not visited by the author). Each of these major divisions is subdivided many times, the final unit being the plant association, covering sometimes only a few acres. Some of the lesser divisions, such as the "New Brunswick area," "interlacustrine area," and "Arkansas-Louisiana district," seem rather arbitrary, but they are no more so than would be divisions based on altitude or isothermal lines, for instance, and in the present state of phytogeographical knowledge it would not be very easy to suggest a better system.

In this part the author has attempted to combine into a harmonious whole his own observations and those of several hundred other explorers, made at different times, from many different points of view, and with various degrees of accuracy and thoroughness, often with no visible marks to distinguish the reliable from the unreliable ones. Under the circumstances it was inevitable that the treatment of different regions should be somewhat uneven, and that some errors should creep in; but until some one has covered the whole ground in a more thorough manner (which is not likely to happen very soon), this part should not be criticized severely. A minor defect apparent here is that original and second-hand observations are not always sharply distinguished; but the footnote references to the writings of other botanists are so numerous that one can hardly blame the author for omitting, or the printers for overlooking, one of them occasionally.

The difficulty of describing the vegetation of parts of North America that one has not personally explored can be fully appreciated only by those who realize that the great majority of our "local floras," at least with the exception of the more recent ones, are mere lists of plants, arranged taxonomically or alphabetically, or sometimes in no logical order, without reference to the manner of their occurrence in nature. Some indeed mention the habitat of each species in a more or less desultory way, but few (almost none up to the time when this series of monographs was inaugurated) give any idea of the way in which the plants are associated to make up the vegetation, and still fewer indicate the relative abundance of the species in their associations. The dearth of descriptions of vegetation is especially noticeable in New England, where there are, and always have been, more botanists than in any equal area in the Western Hemisphere. It would probably be difficult to find in botanical literature definite statements about the habitats of more than half the species of flowering plants in the United States. Even in the latest descriptive flora of the northeastern states ("Gray's Manual," 7th edition, 1908), a great many species are left without the slightest indication of habitat, and the thirty-volume "North American Flora," now in course of publication by the New York Botanical Garden, ignores habitats almost completely.

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* See *Bull. 10*, Biological Survey, 1898; also frontispieces to "Check List of North American Birds" 3rd edition, Amer. Ornithologists' Union, New York, 1910, and "Forest Physiography" by I. Bowman, 1911.

A fruitful source of error in such compilations as Dr. Harshberger's is the fact that in different botanical papers the same name is often applied to perceptibly different plants in different regions by persons who have had no opportunity to make the necessary comparisons, or (which is perfectly natural and excusable) have not been aware of differences that were not known at all at the time; and different names are often given to the same plant at different times, owing to changes in classification and nomenclature which are going on more or less continually. Only a person who is constantly employed in taxonomic work (and the proportion of botanists thus employed seems to be steadily decreasing) can reasonably be expected to keep up with such changes. (That the author has not been oblivious of such difficulties is shown by the second footnote on page 547, where a confusion in names between two western hemlocks is pointed out.) His own identifications of plants in the field are sometimes erroneous, but such mistakes would be made by any one who travels too rapidly to make specimens of every doubtful plant for subsequent study and comparison. Those who are most careful in these matters simply cannot cover as much ground in a season or in a lifetime as those who are content with more superficial observations. From the phytogeographer's point of view it is not absolutely essential that every plant should be correctly identified, anyway, for it would be quite possible to prepare a fairly satisfactory description of the vegetation of a given region without naming a single species.

A colored map of North America on the scale of 1:40,000,000, lithographed by Brockhaus of Leipzig, is inserted at the end of the volume. This map, which has been given very little notice by previous reviewers, particularly the untraveled ones, is undoubtedly the best vegetation map of the continent yet published; in fact there is hardly anything else that approaches it. The author has here tried to represent the vegetation provinces (which would also serve very well for other geographical purposes) just as they are, regardless of any unproved hypotheses of temperature control, effects of evaporation, etc., and he has succeeded pretty well, considering the small scale. Over thirty divisions (which do not correspond exactly with those in the text, but seem more natural) are distinguished by different colors and patterns, and the limits of the ranges of about twenty species of trees are indicated by lines of various kinds; the whole making almost too much detail for a map of that size.

The work is further embellished by four outline paleogeographical maps, 12 line-cuts of rare or interesting plants (all of these last taken from Engler & Prantl's Natürliche Pflanzenfamilien, like many of the illustrations in previous volumes of the same series, and included in Chapter 4 of Part 3, which relates to the geographical affinities of the flora), and 37 half-tones, from various sources. Twenty-one of the half-tones are beautifully executed on inserted plates, and seem to be from exceptionally good photographs, some of which are here published for the first time.* With such a limited number of illustrations some very interesting and fairly well-known regions, such as New England, Georgia, Alabama, Louisiana, Cuba, Bermuda, and the whole territory between the Appalachian Mountains and the Mississippi River, are not represented at all; but of course it would have been impossible to illustrate such a comprehensive work adequately without greatly increasing its bulk and cost.

The index, covering 86 pages, is said to contain 7,400 plant names, including many synonyms. (It should be noted here that this volume deals not only with flowering plants and ferns, but also with the less conspicuous lower cryptogams, though to a much lesser degree, for the latter are much less frequently mentioned in phytogeographical works, and accurate information about their distribution is scarce.) Some of the species are mentioned over fifty times, and most of them more than once, so that there must be at least 15,000 page-references in the index. And this seems to have been compiled by the author himself, instead of being delegated to some uninterested person, as is too often the case with indexes.

Over 1,100 different authors, collectors, explorers, etc., are mentioned in the book, and an index to their names would have been a useful addition; for as it is, a reader desirous of knowing whether or not some particular paper was consulted by the author must look in one or more divisions of the main bibliography, and then if he does not find it there he cannot be sure that it is not mentioned in some of the very numerous footnotes, which, as before stated, contain many additional titles. The lack of an index to localities has been commented on by one critic, but that is not a serious matter in a work whose contents are arranged geographically for the most part, and, furthermore, it would be very hard to decide just how much to include in such an index.

On the whole, Harshberger's Phytogeographic Survey, instead of being an "unfortunate volume," as one reviewer has called it, is one of the most valuable contributions to North American geography ever published. It is essentially an encyclopedia of North American vegetation—the only one of its kind, too—and its shortcomings are mostly those common to all encyclopedias. The botanist who wishes to find out something about the vegetation of distant parts of the continent will find in it references to most of the available botanical literature for each region, and copious extracts from some of the more important papers; and it ought to stimulate those who find their own neighborhoods inadequately described into supplying the missing data to the botanical public, especially in those thickly settled and much-botanized regions where the possibility of discovering new species or even new stations for plants is almost exhausted, and where there are many once enthusiastic botanists whose scientific activities have almost ceased, apparently for lack of a good example to turn them from the old-fashioned botany of the herbarium and laboratory to the comparatively untrodden field of phytogeography.

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* Plate 10 is evidently from the same photograph as Plate 29 in the Twelfth Annual Report of the U. S. Geological Survey, Part I, 1892.